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ABSTRACT

Biology 30 is a twelfth-grade biology course for students in Alberta, Canada. This document is a final test for the course. Intended for administration during January, 1986, it contains 80 multiple-choice questions and nine written-response questions. Two-and-one-half hours are allowed for completing the test. No answer key is included since scoring is done by the provincial education department. (ML)

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ED274546

GRADE 12 DIPLOMA EXAMINATION

Biology 30

January 1986

Alberta
EDUCATION

U.S. DEPARTMENT OF EDUCATION
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GRADE 12 DIPLOMA EXAMINATION
BIOLOGY 30

DESCRIPTION

Time: 2½ hours

Total possible marks: 100

This is a **CLOSED-BOOK** examination consisting of two parts:

PART A: 80 multiple-choice questions each with a value of 1 mark.

PART B: Nine written-response questions for a total of 20 marks.

GENERAL INSTRUCTIONS

Fill in the information on the answer sheet as directed by the examiner.
For multiple-choice questions, read each carefully and decide which of the choices BEST completes the statement or answers the question. Locate that question number on the answer sheet and fill in the space that corresponds to your choice. USE AN HB PENCIL ONLY.

Example

This examination is for the subject area of

A. Chemistry
B. Biology
C. Physics
D. Mathematics

Answer Sheet

A	B	C	D
①	●	③	④

If you wish to change an answer, please erase your first mark completely.

For written-response questions, read each carefully, show all your calculations, and write your answer in the space provided in the examination booklet.

NOTE: The perforated pages at the back of this booklet may be torn out and used for your rough work.

DO NOT FOLD EITHER THE ANSWER SHEET OR THE EXAMINATION BOOKLET

The presiding examiner will collect the answer sheet and examination booklet for transmission to Alberta Education.

JANUARY 1986

PART A

INSTRUCTIONS

There are 80 multiple-choice questions with a value of one mark each in this section of the examination. Use the separate answer sheet provided and follow the specific instructions given.

NOTE: The perforated pages at the back of this booklet may be torn out and used for your rough work.

WHEN YOU HAVE COMPLETED PART A, PROCEED DIRECTLY TO PART B

DO NOT TURN THE PAGE TO START THE EXAMINATION UNTIL TOLD TO DO SO BY THE PRESIDING EXAMINER.

1. A cell membrane is composed of

   A. fatty acids
   B. amino acids
   C. carbohydrates and proteins
   D. fatty substances and proteins

2. A function of the cell membrane is to

   A. synthesize cellular secretions
   B. generate energy for use in the cell
   C. regulate what enters and leaves the cell
   D. provide a surface area for chemical reactions

3. A process by which large particles are engulfed by cells is

   A. diffusion
   B. exocytosis
   C. endocytosis
   D. passive transport

4. Cytoplasm of human brain cells was tested for certain organic compounds. In which of the series below would ALL three tests show positive results?

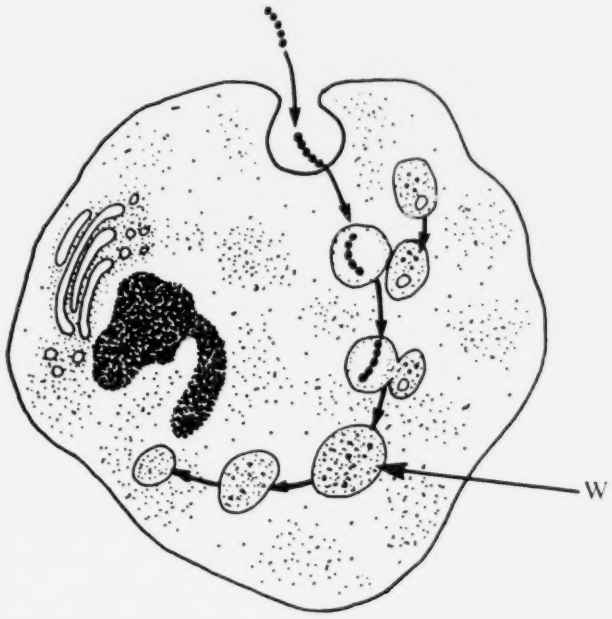
   A. Biuret, Sudan IV, and starch test
   B. Biuret, Sudan IV, and iodine test
   C. Biuret, translucence, and starch test
   D. Biuret, Sudan IV, and Benedict's test

5. What will happen when a sac made of a semi-permeable membrane filled with glycerol is suspended in a beaker of distilled water? There will

   A. be a net movement of water into the bag
   B. not be any movement of glycerol or water
   C. be a net movement of water out of the bag by osmosis
   D. be a net movement of glycerol out of the bag by osmosis

Use the following information to answer question 6.

A Functioning White Blood Cell



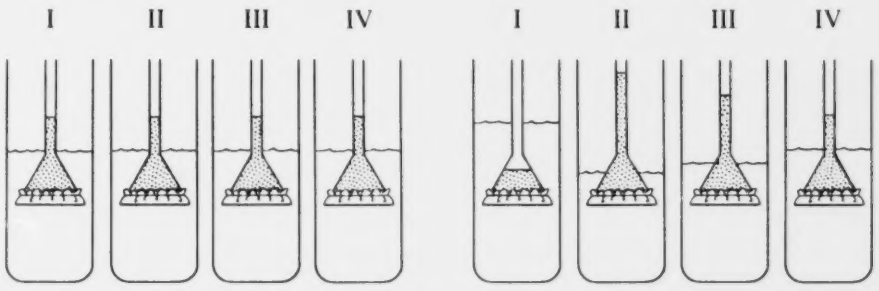
6. Which cytoplasmic organelle is responsible for the occurrence of the activities within W?

A. Ribosome
B. Lysosome
C. Mitochondrion
D. Golgi apparatus

7

Use the following information to answer question 7.

Four funnels are partially filled with various concentrations of a sugar solution and sealed with membranes that are impermeable to sugar and permeable to water. The funnels are then placed in beakers containing an initial 1% sugar solution and left for two hours.



7. Which funnel contained a 1% solution of sugar?

A. I
B. II
C. III
D. IV

---

8. Enzymes alter the rate of a reaction by

A. decreasing the activation energy
B. increasing the activation energy
C. decreasing the amount of substrate
D. increasing the amount of substrate

9. Stress creates an abnormal increase of substance X in the body. Homeostasis may be maintained by

A. decreasing production of X
B. increasing production of X
C. producing X at a steady rate
D. effecting no change in the production of X

10. A poison inhibits the activity of an enzyme involved in the breakdown of glucose in a cell. The poison may act by

A. reducing the energy of activation
B. occupying the active site of the enzyme
C. altering the shape of the glucose molecules
D. increasing electron transfer in the mitochondria

11. The structure that usually ensures that food will pass directly into the digestive tube and not into the trachea is the

A. larynx
B. pharynx
C. epiglottis
D. esophagus

12. Products of carbohydrate digestion are absorbed mainly in the

A. stomach
B. pancreas
C. large intestine
D. small intestine

13. The organ that removes many substances from the blood is the

A. liver
B. heart
C. pancreas
D. gall bladder

14. Peristalsis in the esophagus is stimulated by

A. hormones
B. lack of food
C. presence of food
D. decrease in production of salivary amylase

15. Which situation provides the BEST evidence to support the prediction "Secretion of enzymes from the pancreas is under nervous control?"

A. If there is no food in the stomach or small intestine of a dog, the pancreas will not secrete enzymes.
B. If the nerves leading to the pancreas of a hungry dog are cut, no enzymes are secreted by the pancreas.
C. When the nerves leading to the pancreas of a dog are cut and weak acid is placed in the intestine, the pancreas secretes enzymes.
D. When the circulatory systems of two dogs are connected and food is placed in the intestine of one dog, the pancreas in both dogs secrete enzymes.

16. One symptom of diabetes mellitus is the presence of sugar in the urine. Which reagent would assist in diagnosing this condition?

A. Sudan IV dye
B. Biuret reagent
C. Iodine solution
D. Benedict's solution

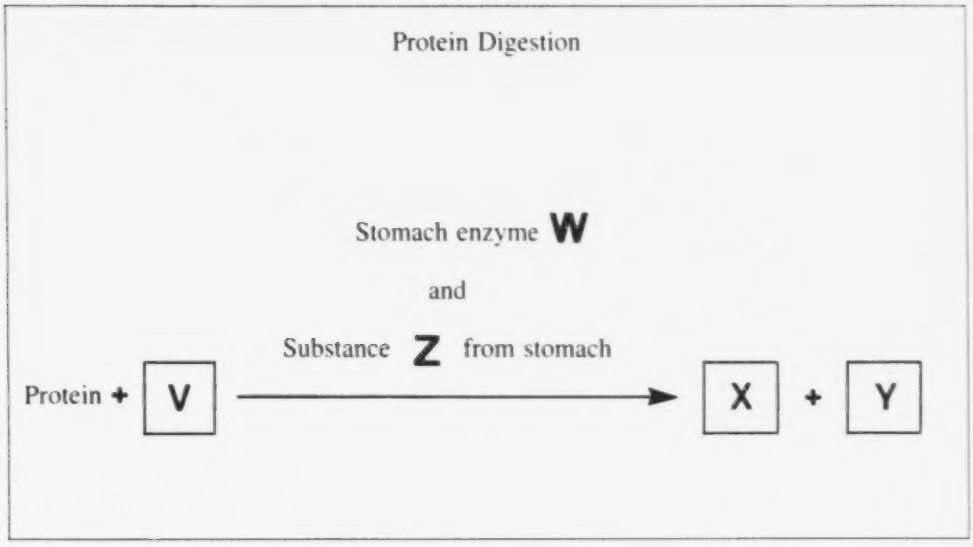
17. If a human is deprived of food for a long time, in which order are the energy reserves of the body normally utilized?

A. Fats, carbohydrates, proteins
B. Carbohydrates, fats, proteins
C. Carbohydrates, proteins, fats
D. Proteins, carbohydrates, fats

18. If an athlete needs a quick energy source, the best source would be

A. fat
B. protein
C. vitamins
D. carbohydrates

Use the following information to answer question 19.



19. Substance W could most likely be

A. gastrin
B. secretin
C. pepsinogen
D. hydrochloric acid

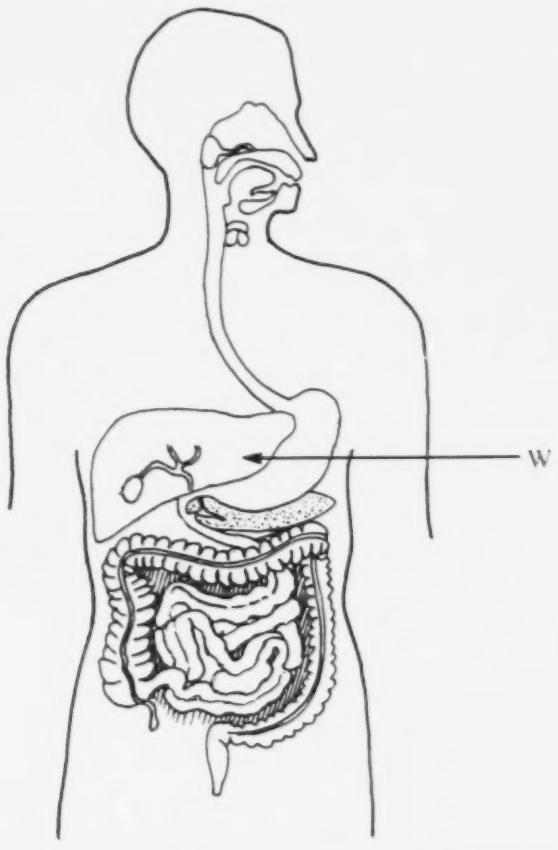
---

20. The primary reason that a low concentration of carbohydrates is normally found in cytoplasm is because carbohydrates are

A. fat soluble
B. used as a source of energy
C. the building blocks of protein
D. the building blocks of plasma membranes

Use the following information to answer question 21.

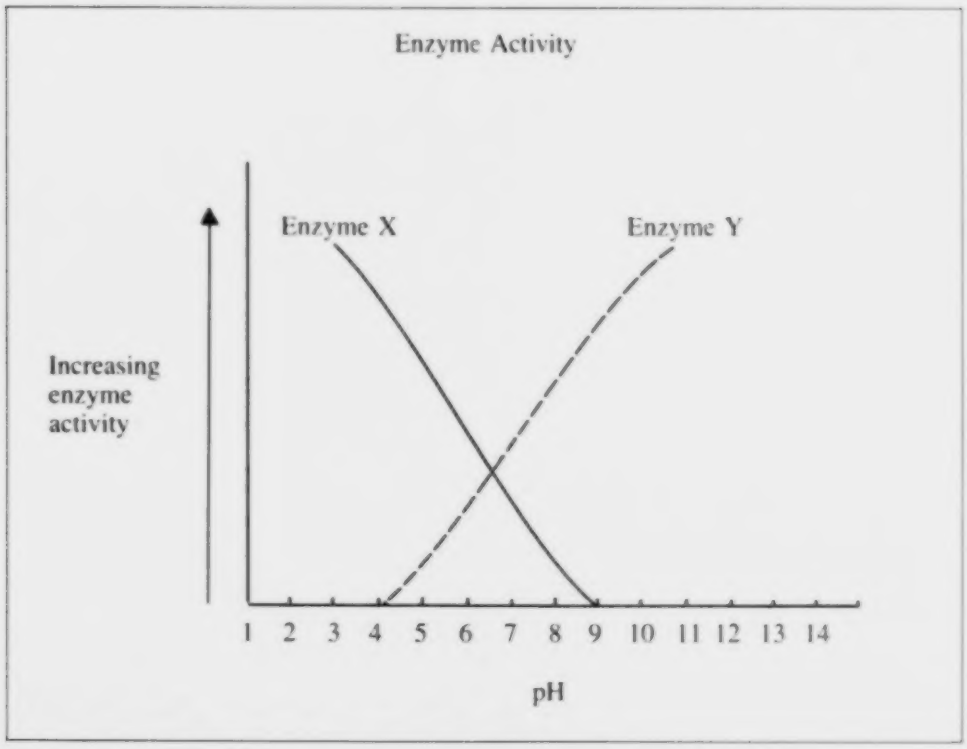
Digestive System



21. Organ W has many functions. The function directly related to digestion is the

A. production of bile
B. storage of vitamins
C. deamination of amino acids
D. maintenance of glucose levels in blood

Use the following information to answer question 22.



22. The digestion of protein is initiated by the enzyme labelled

A. Y, which works best in the stomach
B. X, which works best in the stomach
C. X, which works best in the small intestine
D. Y, which works best in the small intestine

Use the following information to answer question 23.

Test tube 1 contains vegetable oil.
Test tube 2 contains egg-white.
Test tube 3 contains a glucose solution.
Test tube 4 contains cornstarch.

23. A small amount of gastric juice is added to each of the four test tubes. After the test tubes are incubated for four hours at body temperature, the digestive process will be MOST advanced in the contents of test tube

A. 1
B. 2
C. 3
D. 4

---

24. Contraction of the left ventricle normally forces blood into the

A. aorta
B. left atrium
C. pulmonary vein
D. pulmonary artery

25. A homeostatic response to a decline in blood pressure would be a

A. vasodilation
B. vasoconstriction
C. decline in heart rate
D. decrease in aortic pressure

26. Blood returns to the heart from the lower body through the

A. aorta
B. pulmonary vein
C. inferior vena cava
D. superior vena cava

27. Leukocytes are important in the

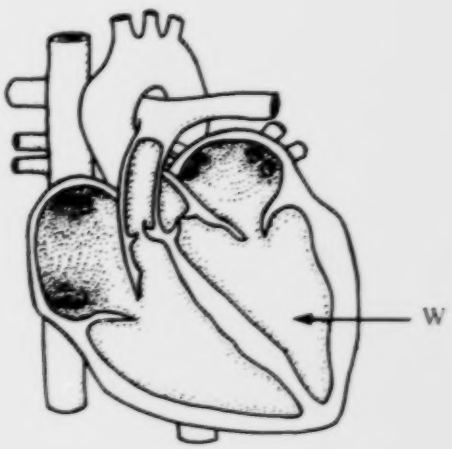
A. formation of antibodies
B. formation of red blood cells
C. engulfing and digesting of food particles
D. transportation of carbon dioxide in the blood

28. A stroke may be caused by a blockage of a blood vessel in the

A. brain
B. heart
C. coronary artery
D. pulmonary artery

Use the following information to answer question 29.

The Human Heart



29. Blood passing through the structure marked W is

A. oxygenated
B. deoxygenated
C. going to the lungs
D. coming from the body

Use the following information to answer question 30.

Events in Heart Contractions Listed in Random Order

1. Semilunar valves open
2. Atrioventricular valves close
3. Atrial contraction begins
4. Ventricular contraction begins

30. Which sequence correctly describes the series of events that occurs after the sinoatrial (SA) node emits an impulse?

A. 4 → 2 → 1 → 3
B. 3 → 1 → 4 → 2
C. 3 → 4 → 2 → 1
D. 4 → 3 → 1 → 2

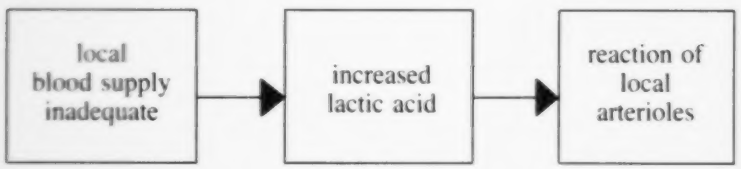
---

31. The blood vessel designed to withstand the GREATEST blood pressure is the

A. aorta
B. vena cava
C. pulmonary artery
D. alveolar capillary

Use the following information to answer question 32.

Blood Flow



32. The response of the local arterioles will be to

A. dilate, therefore increasing O_2 supply
B. dilate, therefore decreasing O_2 supply
C. constrict, therefore increasing O_2 supply
D. constrict, therefore decreasing O_2 supply

---

33. When a person stands up after lying down for a period of time, there is a momentary drop in blood pressure. To restore homeostasis one would expect the stretch receptors in the right atrium to send

A. more inhibitory impulses, resulting in increased cardiac output
B. more inhibitory impulses, resulting in decreased cardiac output
C. fewer inhibitory impulses, resulting in increased cardiac output
D. fewer inhibitory impulses, resulting in decreased cardiac output

34. The number of red blood cells per millilitre of blood will eventually increase after a person

A. has been on a high fibre diet
B. has been on a high carbohydrate diet
C. moves from the mountains to the seashore
D. moves from the seashore to the mountains

35. If protein progressively accumulates in the extracellular fluid (ECF) the balance between it and the cytoplasm will be affected in such a way that there will be

A. a decreased volume of ECF and a decreased volume of the cell
B. an increased volume of ECF and an increased volume of the cell
C. a decreased volume of the cell and an increased volume of the ECF
D. an increased volume of the cell and a decreased volume of the ECF

36. The actual exchange of gases during breathing occurs across the

A. bronchial wall
B. bronchiole wall
C. pleural membrane
D. alveolar membrane

37. The main function of red blood cells is to carry oxygen from the

A. cells to the lungs
B. lungs to the cells
C. cells to the interstitial fluid
D. interstitial fluid to the cells

38. Anemia may be caused by an iron deficiency. This deficiency may affect a person's ability to

A. transport oxygen
B. produce vitamins
C. produce leukocytes
D. transport bicarbonate ions

39. It is impossible to hold one's breath for very long because breathing will eventually start when

A. O_2 levels decrease and the chemoreceptors are inhibited
B. O_2 levels increase and the chemoreceptors are stimulated
C. CO_2 levels increase and the medulla oblongata is stimulated
D. CO_2 levels decrease and the medulla oblongata is stimulated

40. An abnormally large amount of carbon dioxide in the blood affects one's health because carbon dioxide

A. lowers blood pressure
B. lowers the pH of the blood
C. inhibits the breathing centre
D. drastically reduces the breathing rate

Use the following information to answer question 41.

The following data were obtained from four individuals, V, W, X, and Y, who were suffering from circulatory disorders. A healthy individual Z served as a control. All individuals were the same weight, age, and sex.

Subject	Oxygen Content of Arterial Blood (mL O_2/100 mL of blood)	Oxygen Content of Venous Blood (mL O_2/100 mL of blood)
V	9.5	6.5
W	15.0	12.0
X	19.0	18.0
Y	20.0	13.0
Control (Z)	19.0	15.0

41. The subject suffering from cyanide poisoning, which inhibits the use of oxygen in cells, is

A. V
B. W
C. X
D. Y

42. Complete glucose breakdown and adenosine triphosphate (ATP) production occur in

A. lysosomes
B. mitochondria
C. Golgi apparatus
D. endoplasmic reticula

43. Which would produce the LEAST energy if it is completely broken down chemically in the respiratory process?

A. Fat
B. Protein
C. Glucose
D. Lactic acid

44. When equal weights of lipids and carbohydrates are completely metabolized, lipids will yield

A. less energy
B. more energy
C. less heat energy than carbohydrates
D. the same amount of energy as carbohydrates

45. A vigorously worked muscle will begin anaerobic respiration when

A. supplies of ATP and creatine phosphate are diminished
B. lactic acid and carbon dioxide begin to accumulate
C. the muscle's supply of glucose is depleted
D. oxygen quantities are inadequate

46. Fluid moves into Bowman's capsule by

A. osmosis
B. diffusion
C. force filtration
D. active transport

47. An activity that increases as a result of untreated sugar diabetes is

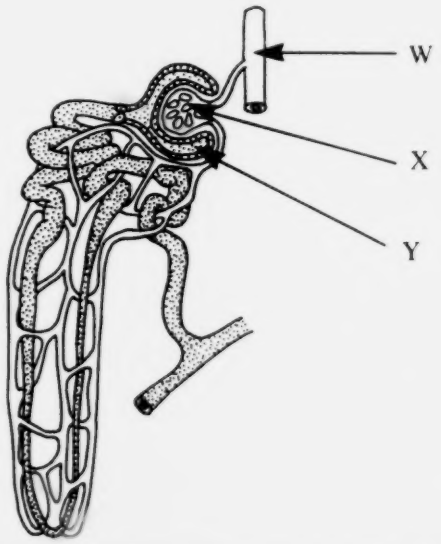
A. use of sugar by tissue cells
B. excretion of glucose by the kidneys
C. release of insulin from the pancreas
D. storage of energy for tissue activities

48. The amount of fluid retained in the body is regulated by both

A. aldosterone and relaxin
B. antidiuretic hormone and relaxin
C. antidiuretic hormone and oxytocin
D. aldosterone and antidiuretic hormone

Use the following information to answer question 49.

A Human Nephron



49. In a person with normal kidney function, plasma proteins would be present in

A. X only
B. W only
C. both X and Y
D. both W and X

---

50. If you ate only meat, your liver would produce large amounts of

A. protein
B. amino acids
C. unsaturated fats
D. urea and energy-rich compounds

Use the following information to answer question 51.

Composition of Plasma, Filtrate, and Urine (g/100 mL fluid)

Components	Plasma	Filtrate	Urine
Urea	0.030	0.030	2.000
Uric Acid	0.004	0.004	0.050
Glucose	0.100	0.100	0.000
Amino Acids	0.050	0.050	0.000
Salt	0.720	0.720	1.500
Protein	8.000	0.000	0.000

51. A reasonable interpretation of the data is:

A. Glucose, amino acids, and proteins are the only components completely reabsorbed into the plasma.
B. Amino acids in the filtrate arise from the breakdown of proteins in the plasma.
C. Uric acid is the most abundant component in urine.
D. The filtrate is plasma minus the blood proteins.

---

52. Dilute urine is produced in response to

A. an activated pituitary gland
B. low antidiuretic hormone levels
C. high antidiuretic hormone levels
D. increased osmotic pressure of extracellular fluid in the kidneys

53. When gallstones obstruct the bile duct, the patient's urine turns brown. This color change is caused by

A. higher concentration of urea in the urine
B. red blood cells escaping into Bowman's capsule
C. plasma proteins filtering through the glomerulus
D. products from the breakdown of bile pigments entering the circulatory system

54. The largest part of the human brain is the

A. cerebrum
B. cerebellum
C. olfactory lobe
D. medulla oblongata

55. Nerve impulses that stimulate rib muscles and the diaphragm originate in the

A. cerebellum
B. temporal lobe
C. occipital lobe
D. medulla oblongata

56. The positive resting potential on the outside of nerve fibres is primarily due to the presence of which ions?

A. Sodium
B. Calcium
C. Chlorine
D. Potassium

57. A gland that secretes BOTH an enzyme and a hormone is the

A. thyroid
B. adrenal
C. pancreas
D. pituitary

58. Our eyes are less sensitive to color at night because

A. rods are concentrated in the fovea
B. there are far fewer rods than cones
C. rods are less functional in dim light
D. cones are less functional in dim light

59. Which part of the brain helps to regulate the amount of water in the urine?

A. Cerebrum
B. Cerebellum
C. Hypothalamus
D. Medulla oblongata

Use the following information to answer question 60.

Mice and humans have similar endocrine structures and hormones. The results of a series of experiments conducted on mice are shown below.

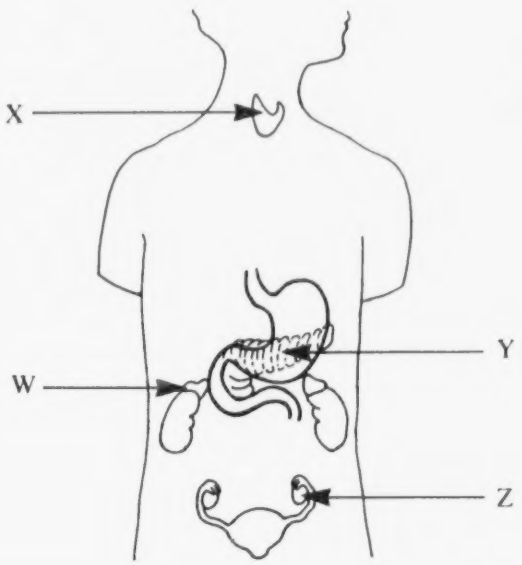
Experiment	Procedure	Result
I	hormone injected	urine output decreased
II	blood flow to anterior pituitary blocked	rate of metabolism decreased
III	hormone injected	female mice developed male secondary sex characteristics
IV	hormone injected	glycogen to glucose conversion increased

60. In which experiment was the hormone glucagon used?

A. I
B. II
C. III
D. IV

Use the following information to answer question 61.

Endocrine System



61. Blood sugar levels are affected by secretions from glands

A. W, X, and Y
B. W, X, and Z
C. W, Y, and Z
D. X, Y, and Z

---

62. A blurred image on the retina would require adjustments to be made in the

A. lens
B. optic nerve
C. iris muscles
D. rods and cones

Use the following information to answer question 63.

Events in Synaptic Transmission Listed in Random Order

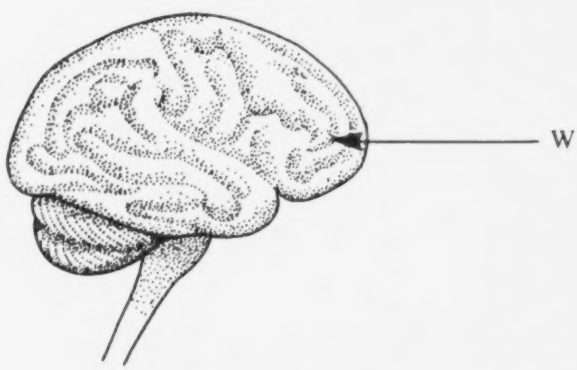
1. Neurotransmitters diffuse across the synapse.
2. Neurotransmitters are enzymatically degraded.
3. Vesicles at the axon end release their contents.
4. Permeability of the membrane of the dendrite end is altered.

63. What is the correct sequence of events in neural transmission as they occur at a synpase?

A. 3 → 2 → 4 → 1
B. 4 → 3 → 2 → 1
C. 4 → 1 → 3 → 2
D. 3 → 1 → 4 → 2

Use the following information to answer question 64.

The Human Brain



64. Predict the most likely result if region W is damaged.

A. Deafness
B. Blindness
C. A loss of balance
D. A changed personality

---

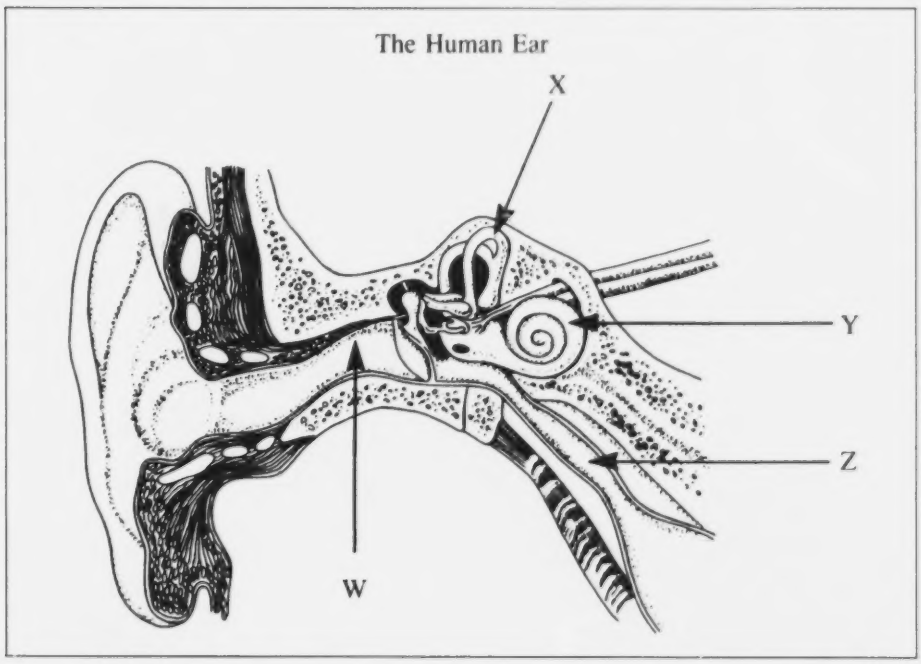
65. A stroke resulted in the following: partial loss of speech, difficulty in using the right arm, and inability to solve mathematical problems. One might interpret that there was damage to the

A. left cerebral hemisphere
B. right cerebral hemisphere
C. left portion of the cerebellum
D. right portion of the cerebellum

66. A color blind person who cannot distinguish between red and green has a defect in the

A. lens
B. rods
C. cones
D. optic nerve

Use the following information to answer question 67.



67. Swallowing and yawning allow atmospheric pressure change to be equalized between

A. W and X
B. W and Z
C. X and Y
D. X and Z

68. Increased parasympathetic nervous activity would cause

A. slower peristalsis
B. a decrease in heart rate
C. increased blood pressure
D. increased blood glucose levels

69. The endocrine control of the reproductive system is functionally linked to the central nervous sytem by the

A. cerebrum
B. adrenal gland
C. pituitary gland
D. medulla oblongata

70. The transmitter substance released at the neuromuscular junction is

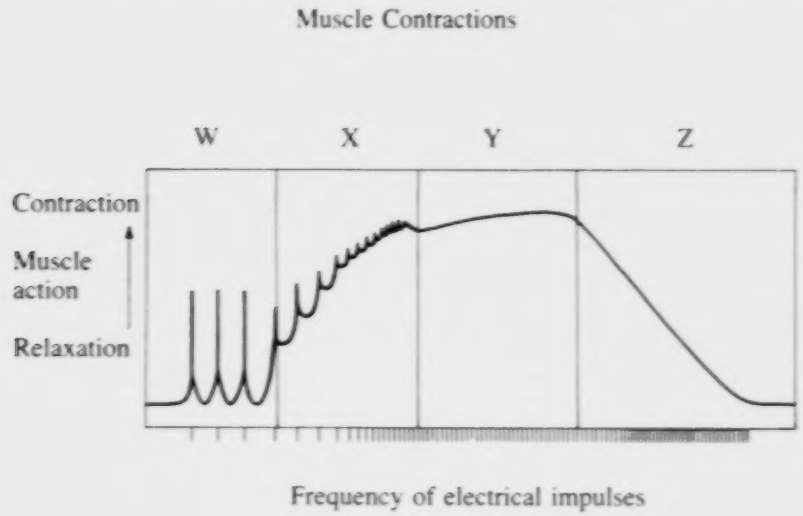
A. acetylcholine
B. cholinesterase
C. sodium chloride
D. calcium chloride

71. The release of calcium ions during muscle function is stimulated by

A. a nerve impulse
B. creatine phosphate breakdown
C. movement of actin and myosin
D. adenosine triphosphate breakdown

Use the following information to answer question 72.

The graph below indicates the effects of muscle stimulation by electrical impulses which are of the same intensity but which increase in frequency.



72. Which area of the graph indicates the greatest metabolic demand for adenosine triphosphate?

A. W
B. X
C. Y
D. Z

---

73. Ova are usually fertilized in the

A. ovary
B. uterus
C. follicle
D. Fallopian tubes

74. The structure responsible for producing sperm is the

A. testis
B. epididymis
C. vas deferens
D. prostate gland

75. A positive pregnancy test indicates the presence of the hormone

A. relaxin
B. estrogen
C. chorionic gonadotropin
D. follicle stimulating hormone

Use the following information to answer question 76.

Some Structures of the Male Reproductive System

1. Urethra
2. Seminiferous tubules
3. Epididymis
4. Vas deferens

76. What is the correct sequence of structures through which sperm pass during ejaculation?

A. 2 → 4 → 3 → 1
B. 3 → 4 → 2 → 1
C. 2 → 3 → 4 → 1
D. 3 → 2 → 4 → 1

77. Direct blood and nerve connections between the mother and the embryo occur

A. virtually never
B. during fetal development
C. during embryonic development
D. throughout the entire pregnancy

78. An infection which resulted in inflammation and blockage of the vas deferens would prevent the

A. passing of urine
B. ejaculation of sperm
C. production of viable sperm
D. ejaculation of prostate secretion

79. During the early stages of pregnancy, progesterone is produced by the corpus luteum. After the corpus luteum becomes inactive, the hormone is produced by the

A. fetus
B. ovaries
C. placenta
D. pituitary gland

80. In normal fetal circulation, the pulmonary arteries and the aorta are connected by a blood vessel. An opening exists between the two atria. These two bypasses in fetal circulation are necessary because

A. the lungs are not yet functional; therefore O_2 is not required
B. CO_2 is not being produced; therefore circulation to the lungs is not needed
C. the fetal blood flow is reversed; therefore pulmonary circulation is not required
D. oxygenation occurs at the placenta and not the lungs; therefore blood flow to the lungs is minimized

YOU HAVE NOW COMPLETED THE MULTIPLE-CHOICE SECTION OF THE EXAMINATION.

PLEASE PROCEED TO THE NEXT PAGE AND ANSWER THE WRITTEN-RESPONSE QUESTIONS IN PART B.

PART B

INSTRUCTIONS

Please write your answers in the examination booklet as neatly as possible.

NOTE: The perforated pages at the back of this booklet may be torn out and used for your rough work.

TOTAL MARKS: 20

START PART B IMMEDIATELY

Use the following information to answer question 1.

The activity of two digestive enzymes obtained from two different organisms was compared over a range of temperatures. Each enzyme was tested with its appropriate substrate.

	0°C	10°C	20°C	30°C	40°C	50°C	60°C
Enzyme A	–	–	+	+ +	+ + +	–	–
Enzyme B	+	+ +	+ +	+ + +	+ + +	–	–

(–) indicates no activity

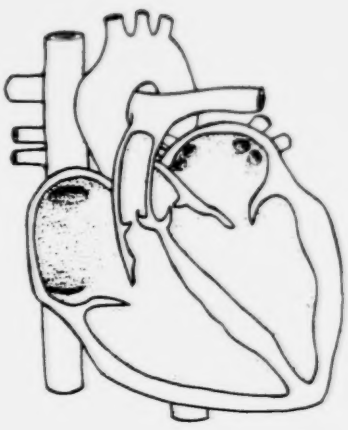
(+) indicates relative amount of activity

(3 marks) 1. a. Draw and label a graph illustrating the data shown above. Use the horizontal axis for the manipulated (independent) variable.

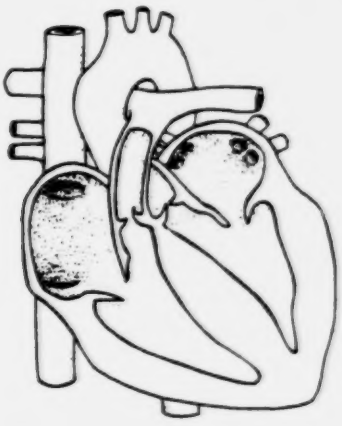
(2 marks) **b.** Which enzyme is from an animal with a constant body temperature? Explain.

(2 marks) **2.** Name and describe a feature of the small intestine that contributes to its great absorptive capacity.

Use the following information to answer question 3.



Subject X's heart before atrioventricular valve damage



Subject X's heart one year after atrioventricular valve damage

(1 mark) **3.** **a.** Describe what change has occurred in subject X's heart.

(2 marks) **b.** Provide a physiological explanation for the structural change in subject X's heart.

(**1 mark**) **4.** A mechanical device called a resuscitator may be used to revive accident victims who have stopped breathing. Explain why the air used in a resuscitator contains a higher percentage of CO_2 than the air normally inhaled.

(**1 mark**) **5.** What is the function of molecular oxygen in cellular respiration?

(**1 mark**) **6.** What adaptive advantage might each of the following have?

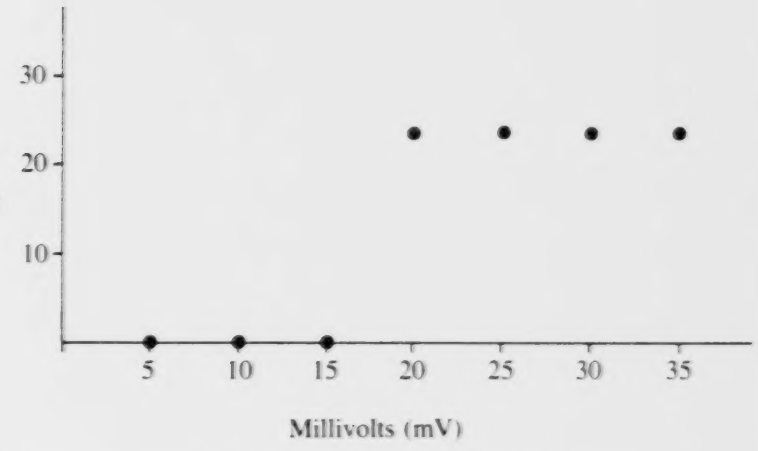
a. Most humans have two kidneys rather than one.

(**1 mark**) **b.** Each kidney contains about one million nephrons.

(**1 mark**) **7.** Explain why an impulse is not sent to the brain when light strikes the blind spot of the human eye.

Use the following information to answer question 8.

Graph of Electrical Stimulation of a Single Muscle Fibre



Note: The fibre was stimulated seven times using different voltages.

(1 mark) 8. a. State the approximate threshold stimulus for this muscle fibre.

_____

(1 mark) b. Explain how the graph indicates the all-or-none response.

_____

_____

_____

(1 mark) c. Why would the same results not be obtained for all muscle fibres of the body?

_____

_____

_____

_____

9. During early development of human males prior to birth, the testes initially appear in the body cavity. However, under normal circumstances they do not remain there.

(1 mark) **a.** State what change occurs in the location of the testes as growth and development proceed.

_____

_____

_____

(1 mark) **b.** Why is this change necessary?

_____

_____

_____

YOU HAVE NOW COMPLETED THE EXAMINATION. IF YOU HAVE TIME, YOU MAY WISH TO GO BACK AND CHECK YOUR ANSWERS.

TEAR OUT SHEET

(NO MARKS WILL BE GIVEN FOR WORK DONE ON THIS PAGE)

FOLD AND TEAR ALONG PERFORATION

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M1 M2 M3 M4

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BIOLOGY 30

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